WHAT WE CLAIM IS:

1. An optical apparatus comprising:

an observation apparatus having an objective, an observation optical system unit including a variable magnification optical system, and an imaging optical system unit including an imaging lens and an eyepiece; and

a fluorescence illumination apparatus removably attached to said observation apparatus;

said fluorescence illumination apparatus including:

a light source;

a reflecting member placed between said objective and said observation optical system unit at a position displaced from an optical axis of said objective to make light from said light source incident on said objective; and

an illumination optical system placed between said light source and said reflecting member to lead illuminating light from said light source to said reflecting member;

wherein a first wavelength selecting member for selectively transmitting light in a specific wavelength region in said illuminating light is placed between said light source and said reflecting member, and a second wavelength selecting member for selectively transmitting light in a wavelength region of fluorescent light emitted from a sample is placed between said objective and said imaging optical system unit.

2. An optical apparatus according to claim 1, wherein

said second wavelength selecting member is integrated with said fluorescence illumination apparatus.

3. An optical apparatus according to claim 1, wherein said second wavelength selecting member is integrated with said first wavelength selecting member.

4. An optical apparatus according to claim 1, further comprising:

a frame for holding said sample;

a post installed on said frame; and

a focusing unit held on said post to change a distance between said sample and said objective;

wherein said focusing unit holds said fluorescence illumination apparatus, and said fluorescence illumination apparatus holds said observation apparatus.

5. An optical apparatus according to claim 1, wherein said observation optical system unit and said imaging optical system unit are each formed from a pair of lens units, said pair of lens units being placed in parallel and symmetry with respect to the optical axis of said objective.

6. An optical apparatus according to claim 1, wherein said objective, said observation optical system unit and said imaging optical system unit are each formed from a pair of lens units, said pair of lens units being placed at a tilt to an axis normal to a surface of said sample and in symmetry with respect to said axis.

7. An optical apparatus according to claim 5, wherein said observation optical system unit and said

imaging optical system unit are placed so that a plane containing optical axes of said lens units is displaced from the optical axis of said objective.

8. An optical apparatus according to claim 1, wherein at least one lens unit of the illumination optical system in said fluorescence illumination apparatus is movable so that an illumination area of said illumination optical system is approximately coincident with an observation area that changes in accordance with a magnification changing operation of an observation optical system in said observation optical system unit.

9. An optical apparatus according to claim 8, wherein said illumination optical system includes:

a collector lens unit for collecting light from said light source;

a first relay lens unit for forming a first image of said light source;

a second relay lens unit for relaying the first image of said light source;

a first reflecting member provided in said first relay lens unit;

an aperture stop placed in a vicinity of the first image of said light source; and

at least one movable lens unit and a second reflecting member provided in said second relay lens unit;

wherein said first wavelength selecting member is interchangeably provided in said illumination optical system.

10. An optical apparatus according to claim 1, wherein a distance between said collector lens unit and said light source is changed to allow critical illumination in which a position where an image of said light source is projected and said sample are approximately coincident with each other.

11. An optical apparatus according to claim 10, wherein a change in the distance between said collector lens unit and said light source is independent of a magnification changing operation of an observation optical system in said observation optical system unit, and a distance D between said light source and a conjugate position to said sample closest to said light source in said illumination optical system satisfies the following condition:

$$|D| \leqq 3 \text{ millimeters}$$

12. An optical apparatus according to claim 2, further comprising:

a mechanism by which said first wavelength selecting member and said second wavelength selecting member are changed to another first wavelength selecting member and another second wavelength selecting member, respectively, in linked relation to each other.

13. An optical apparatus comprising:

an observation apparatus having an objective, an observation optical system unit including a variable magnification optical system, and an imaging optical system unit including an imaging lens and an eyepiece; and

a fluorescence illumination apparatus removably attached to said observation apparatus;

said fluorescence illumination apparatus including:

a light source;

a distal end illumination unit placed in close proximity to said objective; and

an illumination optical system placed between said light source and said distal end illumination unit to lead illuminating light from said light source to said distal end illumination unit;

wherein a first wavelength selecting member for selectively transmitting light in a specific wavelength region in said illuminating light is placed between said light source and said distal end illumination unit, and a second wavelength selecting member for selectively transmitting light in a wavelength region of fluorescent light emitted from a sample is placed between said objective and said imaging optical system unit;

wherein said distal end illumination unit is placed at a periphery of said objective so that a center position of an observation optical system in said observation optical system unit and a center position of illuminating light applied by said fluorescence illumination apparatus coincide with each other on a surface of said sample; and

wherein said illumination optical system has at least one movable lens unit and a moving mechanism, so that said movable lens unit moves in accordance with a change in magnification of said observation optical system

to make an observation area and an illumination area approximately coincident with each other.

14. An optical apparatus according to claim 13, wherein said second wavelength selecting member is integrated with said fluorescence illumination apparatus.

15. An optical apparatus according to claim 14, wherein said second wavelength selecting member is integrated with said first wavelength selecting member.

16. An optical apparatus according to claim 13, wherein said fluorescence illumination apparatus illuminates said sample with light from said light source through said distal end illumination unit without passing through said objective.

17. An optical apparatus according to claim 13, wherein said distal end illumination unit has lenses, at least one lens in said distal end illumination unit being placed so that an optical axis of said lens is displaced from an optical axis of said distal end illumination unit.

18. An optical apparatus according to claim 13, wherein said distal end illumination unit includes an optical member that is formed only from plane surfaces and that makes incident light emerge therefrom only by a refracting action.

19. An optical apparatus according to claim 13, wherein said distal end illumination unit includes an optical member that is formed only from plane surfaces and that makes incident light emerge therefrom by a refracting action and a reflecting action.

20. An optical apparatus according to claim 13, wherein said distal end illumination unit includes, in order from an illumination optical system side:

a first deflection member and a second deflection member provided in a plane perpendicular to a plane containing both an optical axis of said objective and an optical axis of said illumination optical system entering said distal end illumination unit;

said first deflection member deflecting the optical axis of said illumination optical system;

said second deflection member deflecting said optical axis deflected by said first deflection member so that said optical axis extends obliquely to the surface of said sample in a plane containing the optical axis of said objective.

21. An optical apparatus according to claim 20, wherein said distal end illumination unit further includes at least two third deflection members for deflecting the optical axis of said illumination optical system, said at least two third deflection members being provided closer to said light source than said first deflection member in a plane perpendicular to a plane containing both the optical axis of said illumination optical system entering said distal end illumination unit and the optical axis of said objective.

22. An optical apparatus according to claim 13, wherein said distal end illumination unit includes an optical member having at least two toric surfaces.

23. An optical apparatus according to claim 13, wherein said distal end illumination unit includes an optical member having at least one surface that is asymmetric with respect to the optical axis.

24. An optical apparatus according to claim 22, which satisfies the following conditions:

$$Fy<Fx$$

$$0.8<(Fy/Fx)/\cos\theta<1.2$$

wherein θ is an angle formed between the optical axis of the illumination optical system exiting the distal end illumination unit and the optical axis of the objective; Fx is a focal length of the distal end illumination unit in a direction of a minor axis of an elliptical illumination area formed on the sample when it is illuminated by an illumination optical system formed from a rotationally symmetric optical system; Fy is a focal length of the distal end illumination unit in a direction of a major axis of the elliptical illumination area, which is perpendicular to the direction of the minor axis.

25. An optical apparatus according to claim 22, which satisfies the following conditions:

$$|My|<|Mx|$$

$$0.8<(|My|/|Mx|)/\cos\theta<1.2$$

where θ is an angle formed between the optical axis of the illumination optical system exiting the distal end illumination unit and the optical axis of the objective; Mx is a projection magnification of the optical system of the distal end illumination unit in a direction of a minor

axis of an elliptical illumination area formed on the sample when it is illuminated at the angle θ with a rotationally symmetric optical system, which is obtained by Mx=I/Ix', where I is the sample and Ix' is a sample image formed by the distal end illumination unit; My is a projection magnification of the optical system of the distal end illumination unit in a direction of a major axis of the elliptical illumination area, which is perpendicular to the direction of the minor axis, the projection magnification My being obtained by My=I/Iy', where I is the sample and Iy' is a sample image formed by the distal end illumination unit.

26. An optical apparatus according to claim 13, which satisfies the following condition:

$$0.7 \leqq Fob/F \leqq 1.2$$

where F is a focal length of the optical system of the distal end illumination unit, and Fob is a focal length of the objective.

27. An optical apparatus according to claim 13, which satisfies the following condition:

$$0.5 \leqq Sob/S \leqq 1.4$$

where S is a square measure of an area illuminated by the distal end illumination unit, and Sob is a square measure of an area viewed with the objective.

28. An optical apparatus according to claim 13, wherein a region of a lens unit of said objective that is closest to said sample is used as a lens unit of said distal end illumination unit.

29. An optical apparatus according to claim 13, further comprising:

a frame for holding said sample;

a post installed on said frame;

a focusing unit held on said post to change a distance between said sample and said objective;

wherein said focusing unit holds said fluorescence illumination apparatus, and said fluorescence illumination apparatus holds said observation apparatus.

30. An optical apparatus according to claim 13, wherein said observation optical system unit and said imaging optical system unit are each formed from a pair of lens units, said pair of lens units being placed in parallel and symmetry with respect to an optical axis of said objective.

31. An optical apparatus according to claim 13, wherein said objective, said observation optical system unit and said imaging optical system unit are each formed from a pair of lens units, said pair of lens units being placed at a tilt to an axis normal to the surface of said sample and in symmetry with respect to said axis.

32. An optical apparatus according to claim 13, wherein said illumination optical system includes:

a collector lens unit for collecting light from said light source;

a first relay lens unit for forming a first image of said light source;

a second relay lens unit for relaying the first

image of said light source;

an aperture stop placed in a vicinity of the first image of said light source; and

at least one movable lens unit provided in said second relay lens unit.

33. An optical apparatus according to claim 13, wherein a distance between said collector lens unit and said light source is changed to allow critical illumination in which a position where an image of said light source is projected and said sample are approximately coincident with each other.

34. An optical apparatus according to claim 33, wherein a change in the distance between said collector lens unit and said light source is independent of a magnification changing operation of an observation optical system in said observation optical system unit, and a distance D between said light source and a conjugate position to said sample closest to said light source in said illumination optical system satisfies the following condition:

$$|D| \leqq 3 \text{ millimeters}$$